

OCR A Physics A-Level

PAG 4.1

Investigating combinations of resistors

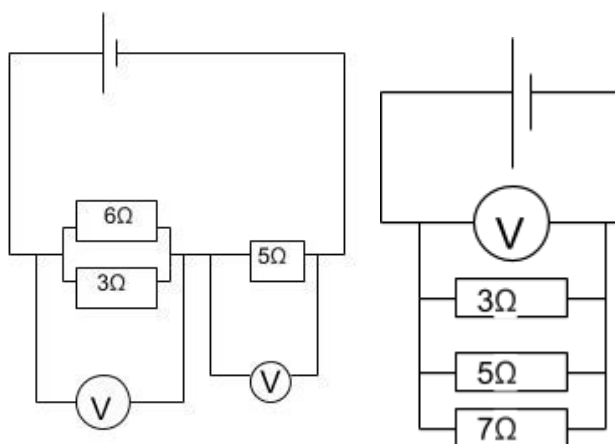


Equipment

- Multiple resistors of different known resistances
- Ohmmeter/multimeter
- Crocodile clips
- Voltmeters
- 5 V power supply
- Leads

Method

1. Check the given resistance of the resistors is accurate by clipping one to some crocodile clips and connecting these to an ohmmeter which will display the actual resistance of the resistor allowing calculations to be more accurate.
2. Design at least 3 circuits such as the two shown below. Connect voltmeters across the resistors of known resistance as shown:



The cells in the example circuits shown are all 5 V.

3. Calculate the theoretical total resistance of each circuit designed:
 - For circuit 1 (left) the resistance is 5 + the combined resistance of the parallel resistors (R_C) $1/R_C = 1/3 + 1/6 = 1/2$ so $R_C = 2 \Omega$ hence the total $R = 7 \Omega$
 - For circuit 2 (middle) the resistors are in series so the combined resistance is $8 + 4.5 + 6 = 18.5 \Omega$
 - For circuit 3 (right) all the resistors are in parallel so $1/R_T = 1/3 + 1/5 + 1/7$
 $1/R_T = 71/105$ $R_T = 105/71 = 1.48 \Omega$ (3sf)
4. Next, record the voltage on each voltmeter and find this voltage as a percentage of the 5 V supply.
5. Find the resistance of each resistor as a percentage of the total resistance of its circuit.
6. Compare the corresponding voltmeter percentages and resistor percentages.
7. You should find that they are approximately equal, this is because the voltage across a resistor is proportional to its resistance, ie. the resistor with $3/4$ of the resistance will have $3/4$ of the available p.d across it.

Safety

- Using a 5 V power supply minimises risk of electrocution and components becoming too hot.

Notes

- Calibrate the voltmeters before connecting them to avoid systematic error.

